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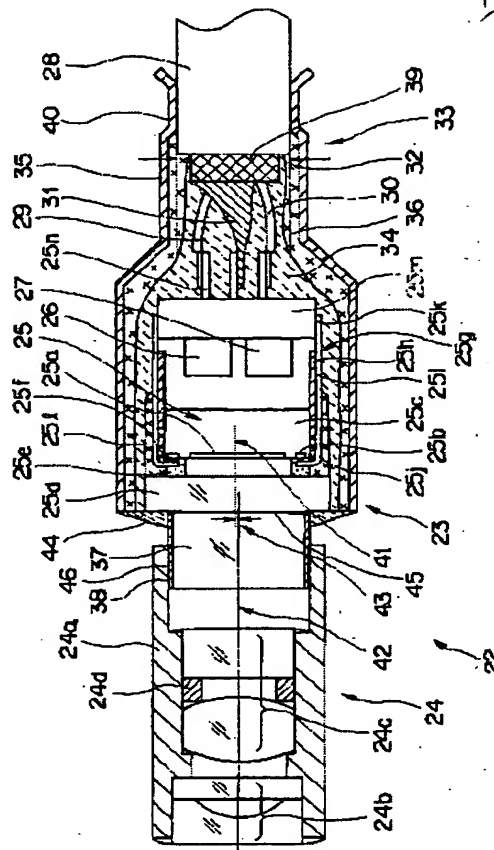
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APPLICANT : OLYMPUS OPTICAL CO LTD;

INVENTOR : YABE HISAO;

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TITLE : IMAGING DEVICE



**ABSTRACT :** PROBLEM TO BE SOLVED: To additionally downsize the external form of an imaging device.

**SOLUTION:** The imaging device 22 has a first optical system unit 23 formed by fastening an optical member to a solid-state imaging device and a second optical system unit 24 formed by arranging the optical member within a frame member. The side peripheral surface of the optical member of the first optical system unit and the frame member of the second optical system unit are fitted to each other. The solid-state image device comprises a solid-state image sensor 25c of a bare chip and cover glass 25d fastened onto this solid-state image sensor 25c. The optical member 37 of the first optical system unit is fastened to the cover glass 25d.

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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

**[The technical field to which invention belongs]** This invention relates to the small image pick-up equipment which was constituted by having a solid state image pickup device and which is arranged at the point of an endoscope etc.

[0002]

**[Description of the Prior Art]** The small image pick-up equipment constituted by having a solid state image pickup device is proposed variously, and is arranged and used for the point of an endoscope etc.

[0003] For example, in JP,9-192093,A, image pick-up equipment has the CCD unit equipped with the charge coupling equipment (CCD:Charge Coupled Device) element as a solid state image pickup device, and the objective lens unit which constitutes object optical system.

[0004] Cover glass is aligned by the image pick-up side of a solid state image pickup device, the CCD unit is joined, and by the adhesives made into the periphery with \*\*, in the holder, cover glass is \*\*(ed) inner and is being fixed. The objective lens unit is constituted by two or more lens groups and two or more lens frames fitting in, and connecting them.

[0005] and the periphery of one lens frame in an objective lens unit and the inner circumference of the holder in a CCD unit are fitted in, and where positioning of the direction of an optical axis of an objective lens unit and a CCD unit was made, carried out focus appearance and is carried out, the objective lens unit and the CCD unit are being fixed.

[0006]

**[Problem(s) to be Solved by the Invention]** this JP,9-192093,A -- setting -- the focus appearance of a CCD unit and an objective lens unit -- carrying out -- fitting immobilization was carried out and the lens frame of the holder of a CCD unit and an objective lens unit was performed. Therefore, in order to make two of the holders of the lens frame of an objective lens unit, and a CCD unit fit in and to perform focus \*\*\*\*, the outer diameter of image pick-up equipment was large by the thickness of a holder.

[0007]

**[Means for Solving the Problem]** Then, this invention aims at offering image pick-up equipment which can attain the further miniaturization of an equipment appearance of image pick-up equipment.

[0008] Image pick-up equipment of this invention has the 1st optical-system unit which an optical member fixed to a solid state camera, and the 2nd optical-system unit which arranges an optical member in frame part material, and changes, and is making a side peripheral surface of an optical member of the 1st optical-system unit, and frame part material of the 2nd optical-system unit fit in.

[0009] Furthermore, a solid state camera in image pick-up equipment of this invention consisted of a solid state image pickup device of a bare chip, and cover glass which fixed on the solid state image pickup device, and an optical member of the 1st optical-system unit has fixed it to cover glass.

[0010] According to such a configuration, since a side peripheral surface of an optical member of the 1st optical-system unit and a peripheral face of frame part material of the

2nd optical-system unit have fitted in, it can position, and focus \*\*\*\* can be performed, and an outer diameter of image pick-up equipment can also be made thin, and a miniaturization of image pick-up equipment can be realized.

### **[Brief Description of the Drawings]**

**[Drawing 1]** The whole endoscope system schematic diagram is shown.

**[Drawing 2]** It is the cross section of a longitudinal direction showing the configuration of the body of image pick-up equipment.

**[Drawing 3]** **Drawing 3 (a)** is the sectional side elevation of a solid state camera 25. **Drawing 3 (b)** is the front view which omitted some solid state cameras 25 seen from [ of **drawing 3 (a)** ] A. **Drawing 3 (c)** is the side elevation which omitted some solid state cameras 25 seen from [ of **drawing 3 (a)** ] B.

### **[Description of Notations]**

- 1 ... Endoscope system
- 2 ... Electronic endoscope
- 3 ... Light equipment
- 4 ... Scope cable
- 5 ... Video processor
- 6 ... Color monitor equipment
- 7 ... Insertion section
- 8 ... Control unit
- 22 ... Image pick-up equipment
- 23 ... Solid state camera unit (CCD unit)
- 24 ... Objective lens unit
- 25 ... Solid state camera
- 25b ... Inlet connection
- 25c ... Solid state image pickup device chip
- 25d ... Cover glass
- 25e ... Adhesives
- 25f ... Bump
- 25g ... Flexible substrate
- 25h ... Substrate
- 25i ... Circuit pattern
- 25j, 25k ... Inner lead
- 26 ... Electronic parts for noise rejection
- 27 ... IC for amplification

[0011] **[Embodiment of the Invention]** Hereafter, the gestalt of operation of this invention is explained with reference to a drawing.

[0012] **Drawing 3** shows the gestalt of operation of this invention from **drawing 1**. **Drawing 1** is the whole endoscope system schematic diagram. **Drawing 2** is the cross section of a longitudinal direction showing the configuration of the body of image pick-up equipment.

[0013] **Drawing 3** is drawing showing the appearance configuration of CCD.

[0014] Based on **drawing 1**, the outline of an endoscope system is explained first.

[0015] The endoscope system 1 shown in **drawing 1** consists of a video processor 5 which performs signal processing to the electronic endoscope 2 equipped with the electromagnetic interference cure means, the light equipment 3 which supplies the

illumination light to this electronic endoscope 2, and the solid state camera 25 which was connected with the electronic endoscope 2 through the scope cable 4, and was built in the electronic endoscope 2, and color-monitor equipment 6 which displays the video signal inputted from this video processor 5 through monitor cable 5a.

[0016] An electronic endoscope 2 has the insertion section 7 of \*\* length inserted into a coelome etc., the control unit 8 formed in the end face side of this insertion section 7, the universal cord section 9 which extended from this control unit 8, and the scope connector area 10 which is prepared in the edge of this universal cord section 9, can detach and attach freely to light equipment 3, and is connected. Contact connector area 10a is prepared in the flank of this scope connector area 10. The scope cable 4 is connected to this contact connector area 10a by electrical connector 4a which can be detached and attached and which was prepared in the end of the scope cable 4. The other end of the scope cable 4 can be freely detached and attached to video processor equipment 5 by electrical connector 4b, and is connected.

[0017] The above-mentioned insertion section 7 consists of the flexible-tube section 21 of the long picture from the end face side of the point 12 which builds in the image pick-up equipment 22 (not shown in drawing 1 ) mentioned later, the bend 13 which was formed in the end face side of this point 12 and which can be curved, and this bend 13 to the head side of a control unit 8.

[0018] The switch section 17 which prepared two or more switch 17a is formed in the crowning of the above-mentioned control unit 8. Moreover, the supplied air and the manual operation button 15 for water supply for performing a supplied air and water supply control, and the manual operation button 16 for attraction for performing attraction control are formed in the side of a control unit 8.

[0019] Furthermore, the bow operating knob 14 is formed in this control unit 8. A bend 13 can be incurvated by operating this bow operating knob 14, grasping the grip section 18.

[0020] Moreover, in the above-mentioned insertion section 7, the supplied air and the water supply duct which is not illustrated are inserted in. It connects with the supplied air and water supply control section controlled by actuation of the supplied air and the manual operation button 15 for water supply of a control unit 8, and this supplied air and water supply duct are connected to the supplied air and the water supply duct further inserted in in the universal cord section 9. It passes along the edge of the supplied air and water supply duct in the universal cord section 9 in the scope connector area 10, and it is connected to the supplied air and the water supply device in light equipment 3. Moreover, the attraction duct which was inserted in in the insertion section 7 and which is not illustrated branches to two near the head side of a control unit 8, and one side is open for free passage to forceps opening 11b. the attraction which another side opens for free passage with the attraction duct in the universal cord section 9 through the attraction control section controlled by actuation of the manual operation button 16 for attraction, and the scope connector area 10 does not illustrate -- it results in a mouthpiece. Moreover, the attraction duct is open for free passage to head opening 11a which carries out a opening by the point 12. <BR>

[0021] Head opening 11a becomes attraction opening at the time of attraction actuation, and when forceps etc. are inserted from forceps opening 11b, it becomes outlets, such as forceps with which a needleworker projects.

[0022] Furthermore, in the insertion section 7, a control unit 8, and the universal cord section 9, the light guide (optical channel) which transmits the illumination light and which is not illustrated is inserted in. The end face side of this light guide is connected to the scope connector area 10. The illumination light supplied from the lamp of the light equipment 3 interior passes along a light guide, and outgoing radiation is ahead

carried out from the apical surface of the illumination window 20 fixed to the point 12, and it illuminates photographic subjects, such as the affected part. Image formation of the optical image of the illuminated photographic subject is carried out to the solid state camera 25 (not shown in drawing 1 ) arranged in that image formation location with the object optical lens unit attached in the observation port 19 which adjoined the illumination window 20 and was prepared, photo electric translation is carried out by this solid state camera 25, and an electrical signal is outputted. An electric cable (not shown in drawing 1 ) is connected to this solid state camera 25, and this cable is connected to the scope connector area 10. The electrical signal from a solid state camera 25 is inputted into the video processor 5 through the noise reduction machine (not shown in drawing 1 ) and the scope cable 4 which were contained in the scope connector area 10.

[0023] Next, based on drawing 2 , the image pick-up equipment about this example is explained.

[0024] Image pick-up equipment 22 consists of a solid state camera unit 23 and an objective lens unit 24. The solid state camera unit 23 forms the 1st optical-system unit which object optical-system components fixed on the solid-state image pick-up chip so that it might mention later. Hereafter, as a solid state camera of the solid state camera unit 23, the example which used the CCD (Charge Coupled Device: charge coupling equipment) element explains as an example. Therefore, the solid state camera unit 23 is hereafter called CCD unit.

[0025] The CCD unit 23 has the solid state cameras 25, such as CCD. Said solid state camera 25 has solid state image pickup device chip 25c and cover glass 25d. This solid state image pickup device chip 25c is the bare chip of a CCD element. As for solid state image pickup device chip 25c, inlet connection 25b for image area 25a of predetermined area, I/O of the actuation control signal of a solid state camera 25 and an output signal, and the supply of an actuation power supply to a pan is formed on the front face. Cover glass 25d, it is joined by adhesives 25e on said solid state image pickup device chip 25c. Moreover, the object optical-system components 37 are joined to a cover glass 25d front face. Cover glass 25d and the object optical-system components 37 fixed with adhesives 45, and have fixed the periphery of the object optical-system components 37 with adhesives 44 for reinforcement. Here, the outer diameter of this object optical-system component 37 is smaller than a cover glass 25d outer diameter. Black processing 38 which the peripheral face of this object optical-system component 37 applied or coated with the black coating etc. is performed. Thereby, trespass of the light from a lens periphery can be intercepted and generating of the flare can be prevented. Moreover, the lens which had power also with the parallel plate is sufficient as the object optical-system components 37.

[0026] Bump 25f is prepared on inlet connection 25b of two trains formed on the outskirts of an edge on the front face of a chip on both sides of image area 25a of solid state image pickup device chip 25c. 25g of some flexible substrates which are TAB tapes is connected by thermocompression bonding on these bump 25f.

[0027] Circuit pattern 25i formed in one side of 25h of substrates formed with polyimide with copper is formed in 25g of flexible substrates. In ends of 25g of flexible substrates, it is exposed from 25h of substrates, and circuit pattern 25i forms inner leads 25j and 25k.

[0028] In inlet connection 25b, bump 25f is connected with inner lead 25j by thermocompression bonding, and transfer of the I/O signal of a solid state camera 25 is performed between solid state image pickup device chip 25c and 25g of flexible substrates.

[0029] Cover glass 25d, when it sees from the direction of the objective lens unit side

mentioned later, it is formed more greatly than the dimension of solid state image pickup device chip 25c. The perimeter of adhesives 25e applied to the front face of image area 25a is filled up with 25l of closure resin so that 25g of some flexible substrates may be closed from a cover glass 25d underside. Spreading of adhesives 25e is described further later.

[0030] Moreover, inner lead 25k is electrically connected with 25m of another substrates. The electronic parts 26 for removing the noise of a pulse signal and IC27 for amplifying solid state camera 25 output signal are mounted in 25m of the substrate. With the field where the electronic parts 26 of 25m of substrates and IC27 are mounted, lead pin 25n for connecting a cable 28 is prepared in the opposite hand (end face side).

[0031] The coaxial signal line 29, the simple line 30, and the coaxial shielding wire 31 which constitute a cable 28 in the lead pin 25n are connected with a pewter. In connection between the coaxial signal line 29 of the cable 28, the simple line 30 and the coaxial shielding wire 31, and lead pin 25n, by attaching so that each line may be settled inside the outer diameter 32 of a cable 28, as an arrow head 33 shows, the outer diameter of the CCD unit 23 by the side of a end face can be made thinner than 25m of substrates of a solid state camera 25, and the miniaturization of image pick-up equipment 22 is attained.

[0032] In the cable 28, two or more coaxial signal lines 29 and two or more simple lines 30 are formed. The actuation control signal to a solid state camera 25 is transmitted through the coaxial signal line 29 under processing of control units, such as a processor which is not illustrated. Moreover, the output signal of the solid state camera 25 amplified by IC27 is transmitted to the processor through the coaxial signal line 29. The actuation power supply of a solid state camera 25 is supplied from the processor side which is not illustrated by the simple line 30.

[0033] Moreover, the coaxial shielding wire 31 is connected to the GND (ground, i.e., touch-down) line of a solid state camera 25. The cable of the simple line 30 is a range (a characteristic impedance is 30ohms or more 60ohms or less.) considered to be the need although the actual solid state camera 25 is driven. a conductor -- resistance -- 4000ohms/km or more 12000ohms/km or less Electrostatic capacity is 100 or more pF/m 140 or less pF/m. It specifies. By specifying in such a range, since the variation in the electrical characteristics of a cable 28 is suppressed within limits which do not affect an image, the driving signal of a solid state camera 25 and an output signal can be transmitted certainly.

[0034] The periphery of a solid state camera 25 and a cable 28 is making it filled up with the adhesives 34 of an epoxy system, and is fixing the member of solid state camera 25 and cable 28 and others. Furthermore, the reinforcement frame 35 is formed in the periphery, and it fills up with adhesives 36 in the reinforcement frame 35. In addition, in the fabrication of image pick-up equipment 22, it lets the reinforcement frame 35 pass on the cable 28 beforehand.

[0035] The cable 28 unfolded the reinforcement frame 35, it extended exceeding the section 39, and has closed the cable 28 in the caulking section 40 of the reinforcement frame. Since immobilization with this reinforcement frame 35 and cable 28 is performed by closing the reinforcement frame 35 in the condition of having been filled up with adhesives 36 in the reinforcement frame 35, it can control the outflow of adhesives 36 and workability's improves. Moreover, since the reinforcement frame 35 and a cable 28 are unified and fixed reinforcement becomes high, bending resistance also improves.

[0036] Moreover, image pick-up equipment 22 contains the object optical-system unit 24 which is the 2nd<sup>o</sup> optical-system unit. The object optical-system unit 24 consists of lens frame 24a, the 1st object optical-system components group 24b, the 2nd object

optical-system components group 24c, and spacer 24d.

[0037] 1st object optical-system components group 24b, 2nd object optical-system components group 24c, and spacer 24d, lens frame 24a \*\* inner and it is fixed to it.

[0038] The peripheral face of the object optical-system components 37 which the CCD unit 23 and the objective lens unit 24 fixed in the front face of a solid state camera 25, and the inner skin of lens frame 24a which constitutes the objective lens unit 24 fit in. In the state of the fitting, focus doubling is performed by moving the object optical-system unit which is the 2nd optical-system unit forward and backward. The CCD unit 23 and the objective lens unit 24 are fixed with adhesives 46, where positioning of the direction of an optical axis is carried out, focus \*\*\*\* was performed and focus doubling is carried out. Therefore, the miniaturization of equipment size can be attained the assembly disposition top of a solid state camera.

[0039] At this time, gap 43 may arise between the optical axis 41 of a solid state camera 25, and the optical axis 42 of the objective lens unit 24, or the angle of deviation may occur further in it. In the member of the member of the CCD unit 23 and the variation of assembly, and the objective lens unit 24 and the variation of assembly, and a pan, with the variation in focus \*\*\*\* of the CCD unit 23 and the objective lens unit 24, these serve as \*\*\*\*\* and arise. Then, when the circuit for angle-of-deviation amendment (not shown) was prepared in the scope connector area 10 of drawing 1 and the angle of deviation arose, an image processing is performed electrically and the angle of deviation was adjusted. even if the improvement in the process tolerance of a member or the assembly precision of each unit, and the optical axis 41 of the CCD unit 23 and the optical axis 42 of the objective lens unit 24 carry out location appearance and it does not improve precision by this, the angle of deviation can be adjusted by the electric image processing, and angle-of-deviation adjustment can be performed easily.

[0040] Next drawing 3 is used and a solid state camera is explained still more concretely.

[0041] Drawing 3 (a) is the sectional side elevation of a solid state camera 25. Drawing 3 (b) is the front view which omitted some solid state cameras 25 seen from [ of drawing 3 (a) ] A. Drawing 3 (c) is the side elevation which omitted some solid state cameras 25 seen from [ of drawing 3 (a) ] B.

[0042] Image area 25a and inlet connection 25b are formed in the front face of solid state image pickup device chip 25c. Two or more bump 25f is prepared in the perimeter of the surface edge which sandwiched image area 25a of solid state image pickup device chip 25c at the shape of 2 trains. On these bump 25f, 25g of some flexible substrates is connected. Coating of the sides and the rear faces other than image area 25a of solid state image pickup device chip 25c is carried out by the insulating coat agent 50 of semiconductor grade. The thickness of coating is 0.1mm or less. Although CCD by which bare chip mounting was carried out for the miniaturization was used in recent years, in the sterilization process of an endoscope etc., there was fear of a possibility that a metal ion may invade into CCD, the image noise by a bare chip touching other conductors, the abnormalities in an image, and destruction according to static electricity further as an erector. This insulating coat agent 50 intercepts a metal ion with a possibility of invading into solid state image pickup device chip 25c at assembly and a sterilization process, and prevents other conductors touching solid state image pickup device chip 25a directly further again.

[0043] Prevention of an image noise which was mentioned above, and the abnormalities in an image can be carried out by this, and destruction by static electricity of solid state image pickup device 25c can also be prevented.

[0044] Cover glass 25d has fixed in the front face of solid state image pickup device chip 25c.

[0045] Drawing 3 (b) is the front view which let transparent cover glass 51 pass and was seen from the image area 25a side of solid state image pickup device chip 25c. A dotted line shows cover glass 25d. As shown in drawing 3 (b), adhesives 25e is carried out with \*\* on solid state image pickup device chip 25c of the solid state camera 25 except image area 25a, and solid state image pickup device chip 25c and cover glass 25d fix. Adhesives 25e is made like with \*\* so that the air pass section 53 may be formed in a part. The space 52 (a slash shows) near image area 25a between solid state image pickup device chip 25c and cover glass 25d stops being sealing in forming the air pass section 53. Thereby, in case autoclave sterilization, such as an autoclave, is performed, the stress produced by the pressure variation in a closed space can be eased, and failure of the faulty connection of bump inlet connection etc. can be mitigated.

[0046] Moreover, solid state image pickup device chip 25c may inspect the property of the chip in the state of a wafer. In that case, a checking terminal is prepared in solid state image pickup device chip 25c, and inspection is conducted using the checking terminal. This checking terminal becomes unnecessary eventually. It is not desirable from points, such as EMC (Electromagnetic Compatibility), to leave this checking terminal to open [ so-called ]. Therefore, this problem is solved by unifying the terminal made in common and a checking terminal. As shown in drawing 3 (c), it connected with inner lead of 25g of flexible substrates 25j, and on 25h of substrates formed with polyimide, two or more input/output terminals of solid state image pickup device chip 25c were unified in the place shown by the lead arrow head 53 in the middle of an inner lead, and are connected with circuit pattern 25i. As long as there are two or more checking terminals, they may be unified similarly. Since circuit pattern 25i in the condition that the checking terminal which becomes unnecessary eventually was unified by one as circuit pattern 25i, and was opened on circuit wiring is lost, it is hard coming to gather a RF noise etc.

[0047] according to [ as explained above ] the above-mentioned configuration -- the focus appearance of the CCD unit 23 and the objective lens unit 24 -- carrying out -- In order to carry out by making the peripheral face of the object optical-system components 37 joined to the cover glass 25d apical surface which fixed to solid state image pickup device chip 25c, and the inner skin of lens frame 24a which constitutes the objective lens unit 24 fit in, The outer diameter of the fitting portions of the CCD unit 23 and the objective lens unit 24 becomes thin, and can also make thin the outer diameter of image pick-up equipment 22. Moreover, in order that the number of fitting of a lens frame and a lens may decrease, assembly nature improves and the angle of deviation decreases. Therefore, the miniaturized image pick-up equipment 22 can be offered. In addition, the feature is in the configuration shown in the next additional remark from the configuration explained above.

[0048] [Additional remark]

(1) Image pick-up equipment characterized by making the frame part material which constitutes the side peripheral surface of the optical member which constitutes said 1st optical-system unit, and said 2nd optical-system unit in the image pick-up equipment which has the 2nd optical-system unit which arranges the 1st optical-system unit and optical member which the direct optical member fixed to frame part material, and grows into a solid state camera fit in, and making it focus.

[0049] (2) Image pick-up equipment given in an additional remark (1) characterized by preparing the air pass section in said solid state camera between the cover glass joined to a solid state image pickup device chip in the front face.

[0050] (3) Image pick-up equipment given in an additional remark (1) characterized by covering the sides and the rear faces other than the image area of a solid state camera by the insulating coat agent of semiconductor grade in said solid state camera.



[0051] (4) Image pick-up equipment given in an additional remark (1) characterized by unifying at least one or more for two or more in-and-out force terminals on a solid state image pickup device chip on the circuit board in said solid state camera.

[0052] (5) Image pick-up equipment given in an additional remark (1) characterized by performing black processing for a side peripheral surface in the optical member which constitutes said 1st optical-system unit.

[0053] (6) Image pick-up equipment characterized by to install the installation location on the circuit board of said lead pin in the image pick-up equipment which has the reinforcement frame arranged so that the cable and the solid state camera which were connected to the circuit board connected to the end-connection child of a solid state camera and this solid state camera and the circuit board, and by which lead PINHE connection is made may be covered so that it may become inside the bunch outer diameter of said cable.

[0054] (7) said -- a cable -- setting -- a cable -- the same axle -- a signal line -- a characteristic impedance -- 30 -- ohm -- more than -- 60 -- ohm -- less than -- the same axle -- a signal line -- an inner conductor -- a conductor -- resistance -- 4000 -- ohm -- /- km -- more than -- 12000 -- ohm -- /- km -- less than -- the same axle -- a signal line - - electrostatic capacity -- 100 -- pF/m -- more than -- 140 -- pF -- seven -- m -- less than -- \*\* -- having carried out -- things -- the feature -- \*\* -- carrying out -- an additional remark -- (-- six --) -- a publication -- an image pick-up -- equipment .

[0055] (8) It is image pick-up equipment given in an additional remark (6) which said cable unfolds some reinforcement frames [ at least ] in said reinforcement frame, extends to the section, and is characterized by fixing a cable by caulking \*\*\*\*\*.

[0056] (9) Endoscope equipment characterized by preparing the circuit for adjusting the angle of deviation of object optical system in said scope connector in the endoscope equipment which has the scope connector which transmits the output signal from a solid state camera and a solid state camera to a processor.

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## CLAIMS

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[**Claim 1**] Image pick-up equipment which is image pick-up equipment which has the 1st optical-system unit which an optical member fixed to a solid state camera, and the 2nd optical-system unit which arranges an optical member in frame part material, and changes, and is characterized by making a side peripheral surface of an optical member of said 1st optical-system unit, and frame part material of said 2nd optical-system unit fit in.

[**Claim 2**] Said solid state camera is image pick-up equipment according to claim 1 characterized by having consisted of a solid state image pickup device of a bare chip, and cover glass which fixed on this solid state image pickup device, and an optical member of said 1st optical-system unit fixing to this cover glass.

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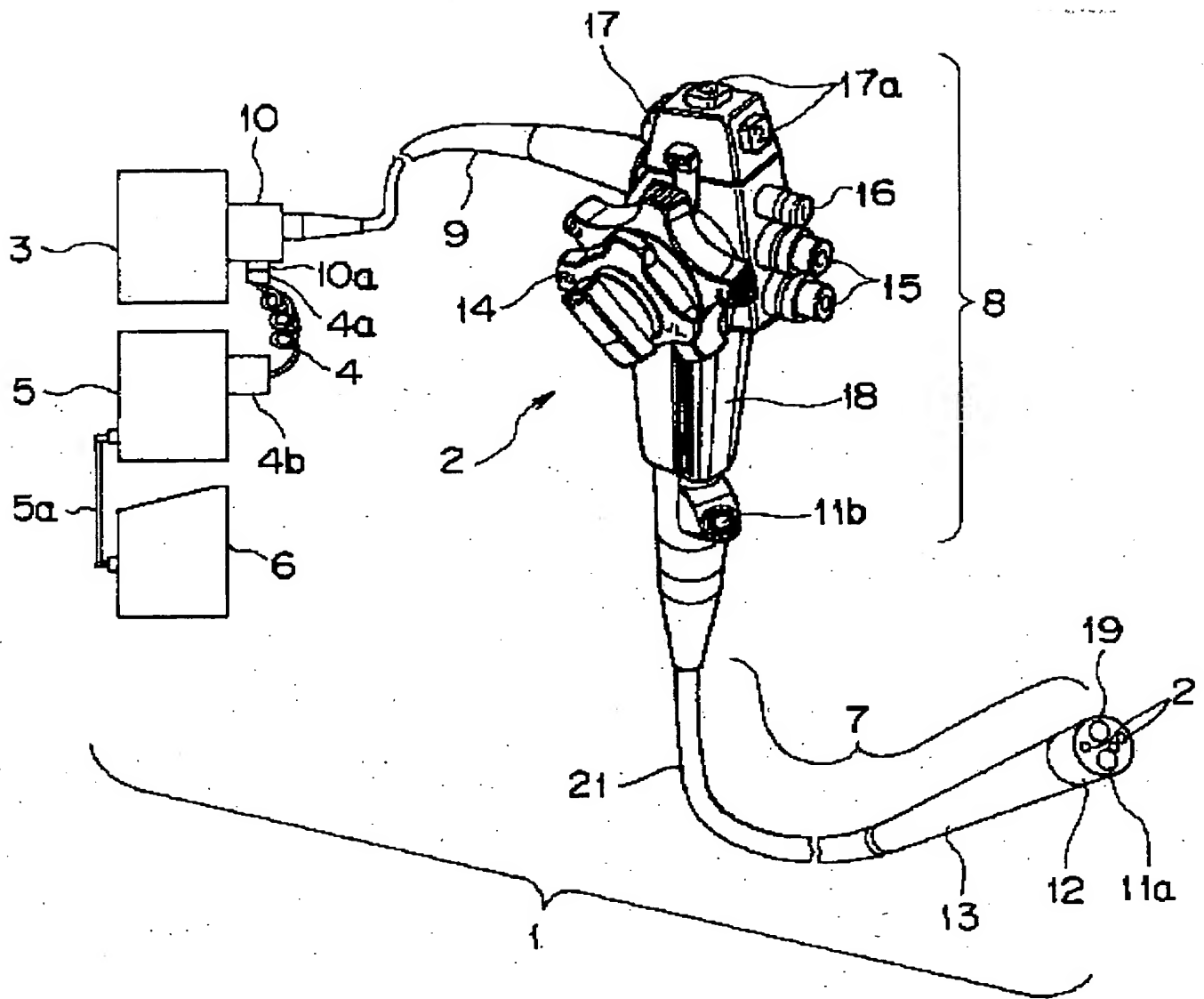
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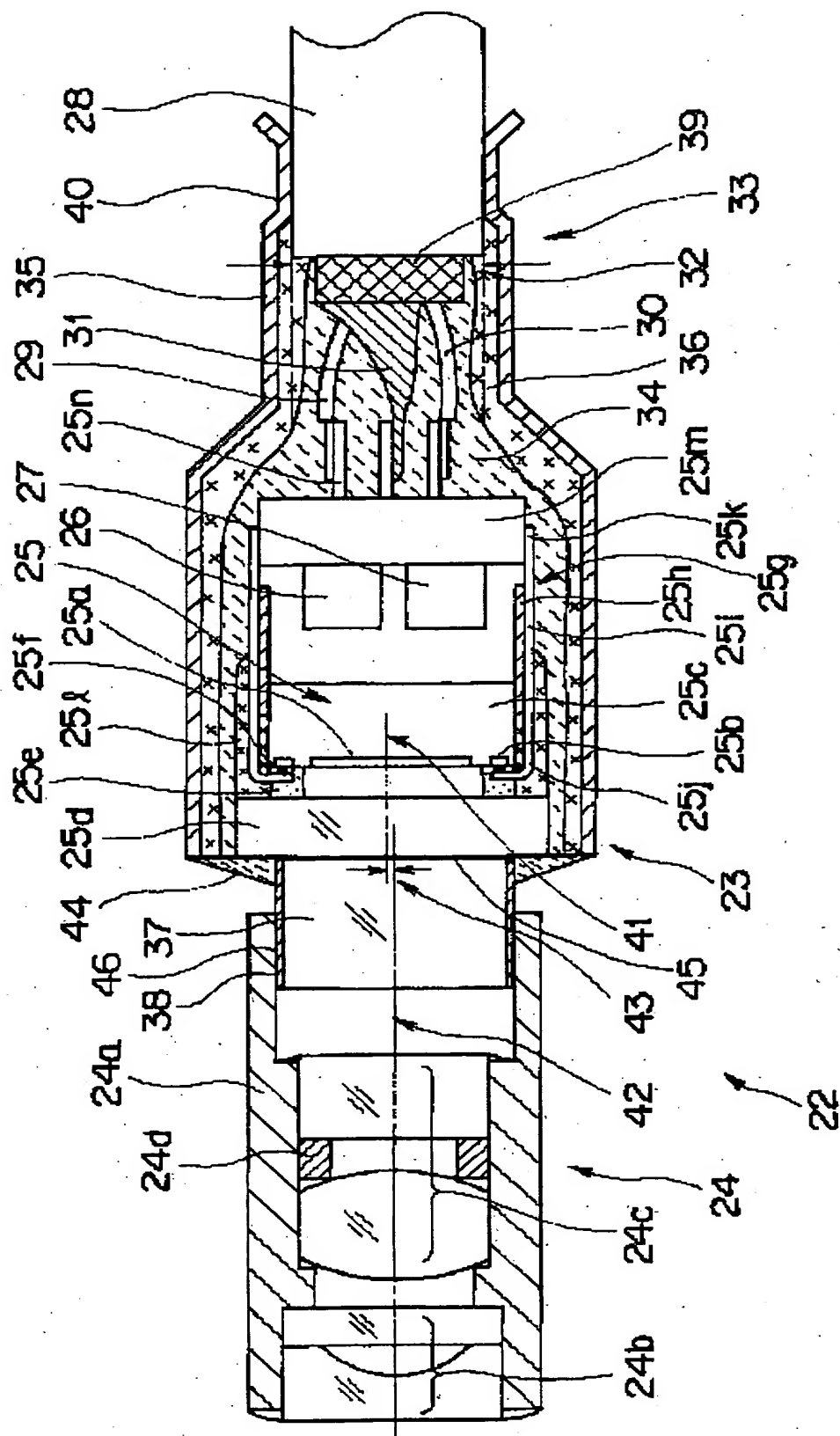
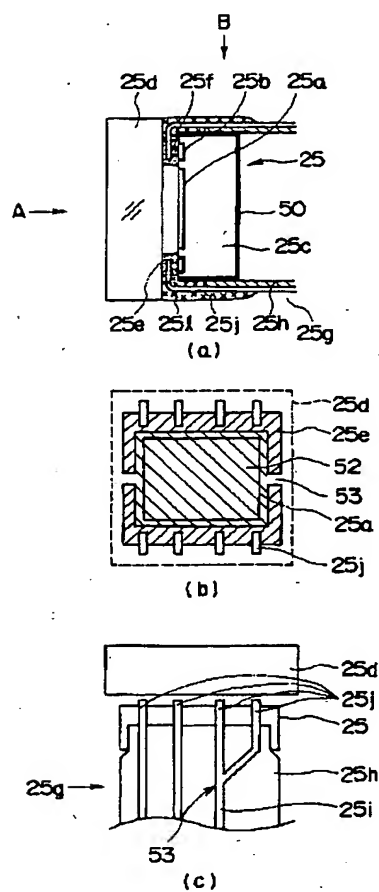


Fig. 2

Drawing selection 

[Translation done.]